**Must-Knows: Unit 10 (Gene Regulation and Biotechnology)**

Ms. Ottolini, AP Biology

**Test Format:** 18 multiple choice questions, 1 short answer question

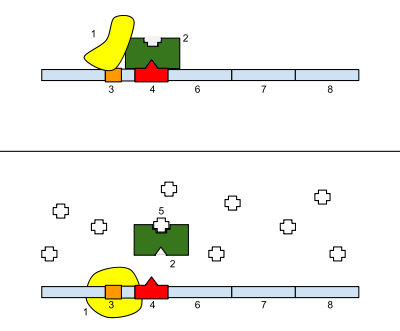
**Topic #1: Gene Regulation**

**Learning Target #1:** I can identify the purpose of gene regulation in prokaryotic and eukaryotic cells.

**Learning Target #2:** I can explain how inducible and repressible operons are regulated in prokaryotic cells.

**Learning Target #3:** I can compare / contrast the different levels of gene regulation in eukaryotic cells.

**Topic #2: Mitosis**

****

With regard to the operon pictured to the right, the image on top shows the operon in its normal state, and the image on the bottom shows the operon in the presence of molecule #5 (looks like a + sign).

1) Identify the different parts of the picture. Your options are repressor, promoter, genes of the operon, operator, RNA polymerase, and inducer.

6-8.

2) What type of operon is shown—inducible or repressible—and how do you know?

3) What is the role of molecule #5 in regulating the operon shown above?

4) Why is a catabolic operon (one that contains genes for enzymes used to break down molecules) usually an inducible operon?

5) Why is an anabolic operon (one that contaisn genes for enzymes used to build molecules) usually a repressibel operon?

6) Let’s say methyl groups are added to the DNA of the gene coding for human growth hormone. How will this affect the amount of human growth hormone produced?

7) Let’s say acetyl groups are added to the histone proteins that interact wth the DNA of the gene coding for human growth hormone. How will this affect the amount of human growth hormone produced?

8) How is the regulation of gene expression different for prokaryotic cells vs. eukaryotic cells?

9) How can changes at the level of mRNA processing (after transcription) produce totally different proteins (ex: variations of the different antibody proteins that are targeted to attack specific bacteria or viruses?

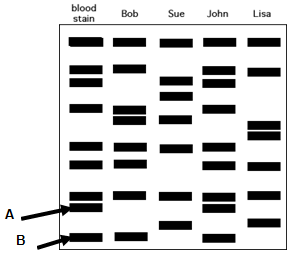
**Topic #2: Biotechnology A**

**Learning Target #4:** I can describe the purpose and methods of gel electrophoresis and analyze electrophoresis results.

**Learning Target #5:** I can describe the purpose and methods of polymerase chain reaction (PCR).

**Learning Target #5:** I can compare the types of DNA mutations and their effects on the resulting protein.

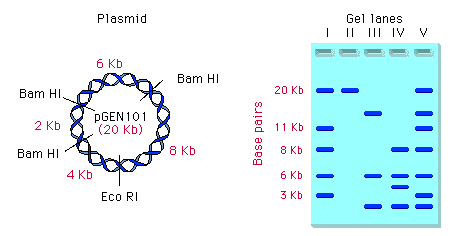
10) Explain the purpose of each of the three factors in polymerase chain reaction (PCR).

1. Heat:
2. Primers:
3. Taq polymerase:

11) Which person in the DNA fingerprint shown to the right—Bob, Sue, John, or Lisa—matches the blood stain DNA? How do you know?

12) If the “wells” of the gel are located up at the top, which DNA fragment is larger—A or B? How do you know?

Below is a plasmid with restriction sites for BamHI and EcoRI. Several restriction digests were done using these two enzymes either alone or in combination. Use the figure to answer questions13–15.

  
**Hint:** Begin by determining the number and size of the fragments produced with each enzyme. "kb" stands for kilobases, or thousands of base pairs.

13) Which lane shows a digest with BamHI only?

14) Which lane shows a digest with EcoRI only?

15) Which lane shows a digest with both BamHI and EcoRI?

**Topic #3: Biotechnology B**

**Learning Target #6:** I can describe the purpose and methods of bacterial transformation and analyze bacterial transformation results.

**Learning Target #7:** I can provide examples of the practical uses of biotechnology.

In a lab experiment that WORKED (clearly not Ms. Ottolini’s lab), scientists transformed *E. coli* bacteria with a plasmid containing the gene for ampicillin resistance (ampR) and the gene to enable the bacterium to glow (pGlo). The pGlo gene is typically turned off but can be turned on in the presence of the sugar arabinose (ara). The scientists attempted to grow cultures of this transformed bacteria in three conditions—plain LB agar (bacteria food), LB / amp, and LB / amp / ara. They then attempted to grow cultures of untransformed bacteria (lacking the plasmid) in the same three conditions. The table below summarizes all the treatment groups.

|  |  |  |  |
| --- | --- | --- | --- |
|  | LB | LB / amp | LB / amp / ara |
| *E. coli* with plasmid | 1 | 2 | 3 |
| *E. coli* without plasmid plasmid | 4 | 5 | 6 |

16) For each plate, state whether there will be bacterial growth, the type of growth (lawn or colonies), and whether the bacteria will glow. Provide an explanation for your answers.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Plate** | **Growth? (yes or no)** | **Lawn or Colonies?** | **Glow? (yes or no)** | **Explanation** |
| 1 |  |  |  |  |
| 2 |  |  |  |  |
| 3 |  |  |  |  |
| 4 |  |  |  |  |
| 5 |  |  |  |  |
| 6 |  |  |  |  |

17) List the steps involved in creating human insulin protein through using recombinant DNA.

18) Golden rice is a transgenic plant, meaning it contains a gene from another organism. In this case, it has been given the gene for the creation of beta carotene (vitamin A). How can a bacterium be used as a “vector” to insert the beta carotene gene into the golden rice plant cells?